determining factor in the weather at any place. The unfailing agreement shown by these calculations arouses suspicion. On closer examination, we find that the signs of the corrections vary quite arbitrarily, while at least five different methods of correcting for declination occur in the text. Results based on such foundations cannot inspire much confidence, even though a fair agreement between predictions and Greenwich records is claimed. The more obvious method of exhibiting the similarity of meteorological conditions under similar astronomical conditions by comparing the corresponding isobaric charts does not appear to have occurred to Mr. Clements. We commend this method to the attention of those who have leisure to devote to a detailed examination of a mode of dealing with meteorology that recurs from time to time.

Bis an's Ende der Welt! Astronomische Causerien. Third Edition. Pp. 212. By Prof. F. J. Studnička. (Prague : Published by the Author, 1903.)

THIS book, which was dedicated to the celebration of Christian Doppler's hundredth birthday, has reached a third edition. It is written in the form of a conversation among men of various professions meeting socially together every day with the intention of conveying in popular language many astronomical ideas. "To the end of the Universe " is the subject of a dream which one of the members of this convivial party, Carpenter by name and astronomer by profession, had dreamt, and the narrative is his account of this dream to his companions, subject, of course, to many interruptions by one or other of them seeking more information or more detailed explanation.

The author has quite succeeded in his object, and the book will be found to contain an admirable exposition of some of the more general astronomical topics. Being printed in large and Roman type, it should find many readers in this country.

Die radioactiven Stoffe nach dem gegenwärtigen Stande der wissenschaftlichen Erkenntnis. By Karl Hofmann. Pp. 54. (Leipzig : Ambrosius Barth, 1903.) Price 1.60 marks.

THIS book contains a concise account of the discovery and subsequent investigation of the radio-active elements by Becquerel, the Curies, Rutherford and others. It is written mainly from a chemical standpoint, and many of the effects which have been accurately measured, especially by Rutherford, are referred to as though they had been merely observed and not measured. For example, Rutherford has shown that the radio-activity of thorium-X dies away with time according to the formula e^{-kt}, where t is the time and k a constant, but Hofmann merely mentions that the activity dies away. The book contains references to the original papers published before the latter half of 1902, and should prove useful to those wishing to study the subject.   H. A. W.

Carnet de Notes d'un Voyageur en France. Par A. C. Poiré. Pp. viii + 169. (London : Macmillan and Co., Ltd., 1903.) Price 1s. 6d.

M. POIRÉ intends this note-book for boys who will in the future be merchants and manufacturers. The provinces and important commercial centres of France are described only from industrial, commercial and agricultural points of view; historical, administrative and geographical details have been omitted as being unnecessary for the particular class of student for whom the book is written.

At the bottom of each page is a vocabulary of difficult or unusual French words. By the time the student has worked through the volume he will not only have much improved his knowledge of French, but have acquired considerable acquaintance with the characteristics of different parts of France.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Radium Emission.

CONCERNING the recently discovered heat emission from radium, it is perhaps worth noting that it appears to be connected with, and is probably an immediate consequence of, the remarkable observation by Rutherford that radium emits massive positively-charged particles, which are probably atoms, with a velocity comparable to one-tenth of the speed of light (see *Phil. Mag.*, February, 1893).

Because it is easy to reckon that the emission of a million heavy atoms per second, which is a small quantity barely weighable in a moderate time such as a few weeks (being about the twentieth part of a milligramme per century), with a speed equal to one-tenth that of light, would represent an amount of energy equal to one thousand ergs per second ; that is to say, would correspond to heat enough to melt a milligramme of ice every hour. And inasmuch as these atoms are not at all of a penetrating kind, but are easily stopped by obstacles, they would most of them be stopped by a small thickness of air, and their energy would be thus chiefly expended in the immediate proximity of the source, which source would thereby tend to be kept warm.

It would appear on this view as if by enclosing a bit of radium in a small chamber formed of massively obstructing non-conducting walls that it could be made quite hot ; provided always that the assumed necessary stimulus, or external supply of molecular energy, could get at it uninterruptedly.

If, in the open, the rate of escape of heat were such that on the average it accumulated for one minute before escaping, the temperature of source and ambient air, with an assumed heat-capacity equal to that of one milligramme of water, would amount to one and a half degrees centigrade.   OLIVER LODGE.
March 28.

Radio-activity of Ordinary Materials.

IN connection with the article by Mr. Strutt on this subject in NATURE of February 19, and the letter by Prof. J. J. Thomson in the following week, it may be of interest to mention some work along similar lines that has been in progress in the McGill Physical Laboratory since September last.

At the same meeting of the American Physical Society in Washington last December, at which the interesting paper of Dr. MacLennan and Mr. Burton, referred to by Prof. J. J. Thomson, was presented, an account was given by Mr. H. L. Cooke and myself of some results showing that a very penetrating radiation was given off from the walls of buildings and from the surface of the earth itself.

The primary object of this investigation was to see if the natural ionisation of air observed in closed vessels was due, in part at least, to an external radiation which passed through the walls of the vessel. For this purpose the rate of discharge of a gold leaf electroscope in a brass vessel of about 1 litre capacity was observed. When the closed vessel was surrounded by thick screens of lead and iron, the rate of discharge was reduced about 30 per cent. A similar effect was observed when the electroscope was immersed in a deep water tank. No further reduction of the discharge was observed when the electroscope was surrounded with five tons of lead. These results showed conclusively that about 30 per cent. of the ionisation in closed vessels was due to an external radiation of great penetrating power which passed readily through 1 cm. of lead. In a brass electroscope, surrounded by thick screens, the number of ions produced was reduced to as low as five per c.c. per second. In the course of these experiments, Mr. Cooke observed that a layer of brick round the electroscope *increased* the rate of discharge instead of diminishing it, pointing to the conclusion that the brick was itself radio-active. Mr. Cooke has extended these observations, using cylinders of different metals placed inside the electroscope, with results of a similar character to those already recorded by Mr. Strutt in his article.

In addition, wood as well as brick was found to be strongly active under the conditions employed. Metals exposed for some time outside the buildings showed a marked increase of activity over the metal which had been carefully cleaned.   E. RUTHERFORD.
McGill University, Montreal, March 12.

Mendel's Principles of Heredity in Mice.

THE points raised by Mr. Bateson in NATURE of March 19 cannot be discussed within the limits of a short letter; a full discussion will be published in an early number of *Biometrika*. In the meantime I would ask Mr. Bateson one question :—

He represents the mice used by Mr. Darbishire as differing in two characters; one (pinkness of eye with white coat) he calls G; the other (pinkness of eye with some colour in the coat) he calls G'. The hybrids produced by crossing these mice he calls GG'; and by reference to the mysterious properties of "heterozygotes" any difficulties presented by their eye-colour are avoided. But when these hybrids are paired *inter se*, they are said to produce offspring of three kinds, in the proportions

$$GG + 2GG' + G'G'.$$

Now the mice G'G' are of the same constitution in respect of all the characters concerned as their pure-bred grand-parent G'. Mr. Darbishire has shown (*Biometrika*, vol. ii. part ii.) that they do not always resemble their grandparent, or either of their parents, in one of the characters (coat-colour) denoted by G'. They may show a new colour, "lilac," not present in any of their near ancestors. Six out of eighteen mice of this category, at present old enough for study, show lilac colour.

I would ask Mr. Bateson's explanation of this fact and of the coat-colour of the first hybrids GG'.
Oxford, March 24.   W. F. R. WELDON.

Historical Note in regard to Determinants.

IN the last-issued part of the *American Journal of Mathematics*, vol. xxv. pp. 97-106, there is a short paper by Mr. E. D. Roe entitled " Note on Symmetric Functions " which in my opinion should not pass unnoticed. It concerns two fundamental theorems regarding alternants which it appears Mr. Roe had previously dealt with in the *American Mathematical Monthly*, vol. vi. (1899) p. 25, and had been there attributed by him to Prof. Gordan. In a footnote he now says :—

" Prof. Metzler has kindly called the writer's attention to the reference to Muir (' Determinants,' p. 176, § 129), from which it appears that Muir has the priority of publication, as far, at least, as theorem i. is concerned. It may, however, be added that in a recent letter Prof. Gordan states that he has used the two theorems for thirty years."

From this it might possibly be inferred that my publication of the said theorem twenty years ago, and Gordan's alleged private use of it thirty years ago, are matters of moment in connection with its history. This would be a fatal error, as the theorem has been in print for at least *seventy-eight* years, having been exhaustively dealt with by Schweins in his " Theorie der Differenzen und Differentiale, . . ." published at Heidelberg in 1825.[1]

The part of my connection with it which gives me most satisfaction is not the fact that I discovered it for myself, but that I discovered an earlier and neglected discoverer of it, Schweins, and have since tried my best to do justice to his merits. His treatise had been absolutely lost sight of, even in Germany, until the appearance of my paper, " An Overlooked Discoverer in the Theory of Determinants," which was published in the *Philosophical Magazine* for November, 1884. In this paper was given a brief account of that portion of his work which concerned *general* determinants, and at the same time it was indicated that this was but a small fraction of the whole contents, several *special* determinants being equally familiar to him. In 1888 the subject was returned to, and entered into more fully in the *Proceedings* Roy. Soc. Edinburgh, vol. xv. pp. 526-542,

[1] *V.* the second Abtheilung (pp. 369-398) and the second chapter of it in particular.

the account there given being afterwards republished in the first volume of my " History of Determinants," pp. 157-173. At a later date Schweins's chapter on alternants, extending to about thirty pages, was dealt with in a similar manner, the account appearing in a paper in the *Proc. Roy. Soc. Edinburgh*, vol. xxiii. pp. 93-132. On pp. 98-103 of this the theorem will be found, accompanied by considerable detail. To the present day, nevertheless, Schweins has not received his due from any of his own countrymen.

Speaking generally, I would urge that the greatest possible caution should be exercised by everyone who finds it necessary to attach to a theorem the name of an author, not merely when the theorem concerns alternants, but when it belongs to any part of the general subject of determinants. As a second example, let us take a case where the mathematician who is unfairly dealt with is not German but English. No fact ought to be better known than that the first discoverer of continuants was Sylvester, his paper containing the discovery having been published in the *Philosophical Magazine* for June, 1853. In the early part of 1875, however, S. Günther published a text-book which assigned the credit to the Danish mathematician, C. Ramus, and notwithstanding the fact that an effort was made in the *Philosophical Magazine* for February, 1877 (vol. iii. pp. 137-138), and still more pointedly in the *American Journal of Mathematics* for 1878 (vol. i. p. 344) to rectify the error, it has lingered on in Germany and the Continent of Europe to the present day. The details of the story are instructive. Günther's statement was :—

" Die Möglichkeit einer solchen Darstellung scheint zuerst von Ramus (*Kjöbenhavn, Vid. Selsk. Overs.* 1855, pp. 106-119) bemerkt worden zu sein : auch Spottiswoode (*Crelle's Journ.*, li. p. 374) und Heine (*Crelle's Journ.*, lvi. p. 97) wurden im Verlaufe anderweitiger Untersuchungen auf dieselbe geführt."

This was republished in 1877 without alteration. In opposition to it the following are the facts :—

(1) As above stated, Sylvester's discovery was published in June, 1853.

(2) Spottiswoode, writing in August of the same year, and having just become familiar with Sylvester's discovery, reproduced the substance of the latter's remarks in the second edition of his " Elementary Theorems Relating to Determinants," which appeared in *Crelle's Journal* in 1856.

(3) In September, 1853, Sylvester returned to the subject (*v. Phil. Mag.* [4] vi. pp. 297-299).

(4) In August, 1854, a result of Sylvester's on the subject appeared in the *Nouv. Annales de Math.*, xiii. p. 305, under the significant title " Théorème sur les Déterminants de M. Sylvester."

(5) In 1855, as Günther states, Ramus made his communication.

These five assertions have always been easily verifiable; and since the claim made publicly in 1877 and 1878, ought to have been verified by any writer who had to refer to the subject. Strange to say, this has never been done, the most recent text-book, Pascal's, having only got as far as the following sentence indicates :—

" I primi che si sono occupati dell' argomento sono stati Ramus, Sylvester, Spottiswoode, Heine, Thiele, e Günther."

If we turn for aid on such matters to the *Encyklopädie der math. Wissensch.*, which is now in course of publication, and aims at being a standard work of reference, there is nought for us but disappointment. In connection with alternants, therein called " Vandermonde'sche " or " Potenzdeterminanten," the name of Schweins is not mentioned, and as for the early history of continuants, we find the old confusion worse confounded. Ramus's paper, it is true, does not appear, but unfortunately we are referred to one of still later date (1858), by Painvin, and to a note which is attributed to Sylvester, but which Sylvester never wrote. The name " continuant," too, is wrongly attributed, and when in connection with the application to continued fractions Sylvester's name is again mentioned, the first date attached thereto is 1859! This may be a misprint for 1853, but if so there is a further error in the specification of the page. Heine's name is still to the fore; unluckily, however, it is not attached to the right paper. Something of Günther's is referred to, but the title is left out.
Cape Town, S.A., February 28.   THOMAS MUIR.